

Section II: Phase Diagram Evaluations

- 78Est:** M.C. Estager and N. Barbooth, "The Solubility of S in Cr-Rich Fe-Cr Alloys," *Mem. Sci. Rev. Metall.*, 75(1), 57-60 (1978) in French. (Experimental)
- 82Ind:** V.M. Indosova, E.G. Zhukov, and V.T. Kalinnikov, "The FeS-Cr₂S₃ System," *Zh. Neorg. Khim.*, 27(2), 533-536 (1982) in Russian; TR: *Russ. J. Inorganic Chem.*, 27(2), 303-305 (1982). (Experimental; #)
- 83Lut:** H.D. Lutz, U. Koch, and H. Siwert, "Phase Relationships of the Ternary Cr^{II}_{1-x}M_xCr^{III}₂S₄ (M = Mn, Fe, Co) with Cr₃S₄ and Spinel Structure," *Mater. Res. Bull.*, 18(11), 1383-1389 (1983). (Experimental; #)
- 87Nar:** T. Narita, T. Ishikawa, and K. Nishida, "Phase Relations in an Fe-Cr-S System at Temperatures of 1073 and 1173 K in the Sulphur Pressure Range from 10⁰ to 10⁻⁵ Pa," *Oxid. Met.*, 27(3-4), 239-252 (1987). (Experimental; #)
- 88Fuj:** T. Fujisawa, M. Asano, T. Suzuki, C. Yamauchi, and H. Sakao, "Activity of Sulfur in Solid Fe-Cr Alloys and Their Equilibrium Rela-

- tions with Sulfides at 1573 K," *Tetsu to Hagané*, 74(6), 1013-1020 (1988) in Japanese. (Experimental; #)
- 88Rag:** V. Raghavan, "The Cr-Fe-S System," *Phase Diagrams of Ternary Iron Alloys. Part 2*, Indian Institute of Metals, Calcutta, 107-120 (1988). (Review; #)
- 88Vla:** K.C. Vlach, "A Study of Sulfur Pressures and Phase Relationships in the Fe-FeS-Co-CoS and Fe-Cr-S Systems," Ph.D. thesis, Univ. Wisconsin, Madison, 188 pages (1988). (Experimental; #)
- 95Smi:** B.J. Smith, J.I. Goldstein, and A.R. Marder, "Application of the Diffusion Couple to Study Phase Equilibria in the Fe-Cr-S System at 600 °C," *Metall. Mater. Trans.*, 26A(1), 41-55 (1995). (Experimental; #)
- 96Nag:** M. Naguchi and T. Narita, "Nonstoichiometry in (Fe,Cr)_{1-δ}S at High Temperatures," *Nippon Kinzoku Gakkai-Si*, 60(6), 589-594 (1996) in Japanese. (Experimental)

Indicates presence of a phase diagram.

Dy-Fe-S (Dysprosium-Iron-Sulfur)

V. Raghavan

Due to lack of data, this system has not been reviewed before. Recently, [91And] determined a pseudobinary section along the FeS-Dy₂S₃ join in this system, which depicts the ternary compound FeDy₂S₄.

Binary Systems and Phases

For a brief review of the Fe-S System, see [88Rag]. [Masalski2] presents the Fe-Dy phase diagram and the intermediate phases in it. The tentative Dy-S phase diagram in [Masalski2] shows a Dy₂S₃ phase as melting congruently at 1775 °C with polymorphic transitions of γ → β and β → α occurring at 1470 and 950 °C, respectively. The temperatures of

the transitions in Dy₂S₃ including its melting point need to be confirmed, as there are wide variations in the values reported in the literature. γDy₂S₃ has the Th₃P₄-type cubic structure with *a* = 0.8303 nm. βDy₂S₃ has the La₂S₃-type orthorhombic structure with *a* = 0.7279 nm, *b* = 0.3878 nm, and *c* = 1.5136 nm. αDy₂S₃ is monoclinic with *a* = 1.7496 nm, *b* = 0.4022 nm, *c* = 1.0183 nm, and β = 98.67° [Pearson3].

The FeS-Dy₂S₃ Pseudobinary Section

Using metallography, x-ray power diffraction, microhardness, and DTA measurements, [91And] determined a pseudobinary section for this system along the FeS-Dy₂S₃ join. This is redrawn in Fig. 1. A stoichiometric ternary compound FeDy₂S₄ forms peritectically at 1347 °C. It has the MnY₂S₄-type orthorhombic structure [91And] with *a* = 0.377 nm, *b* = 1.258 nm, and *c* = 1.288 nm. The final solidification occurs eutectically at 12 mol% Dy₂S₃ and 1087 °C. [91And] indicate only one polymorphic transition in Dy₂S₃ from γ → α at 1217 °C, which does not agree with the Dy-S binary data quoted above. No attempt is made here to modify the diagram in Fig. 1 or to reconcile the differences in the transition temperatures.

Cited References

- 88Rag:** V. Raghavan, "The Fe-S System," *Phase Diagrams of Ternary Iron Alloys. Part 2*, Indian Institute of Metals, Calcutta, 5-9 (1988). (Review; #)
- 91And:** O.V. Andreev, V.G. Bamburov, and V.M. Andreeva, "The FeS-Dy₂S₃ System," *Zh. Neorg. Khim.*, 36(9), 2393-2395 (1991) in Russian; TR: *Russ. J. Inorganic Chem.*, 36(9), 1349-1350 (1991). (Experimental; #)

Indicates presence of a phase diagram.

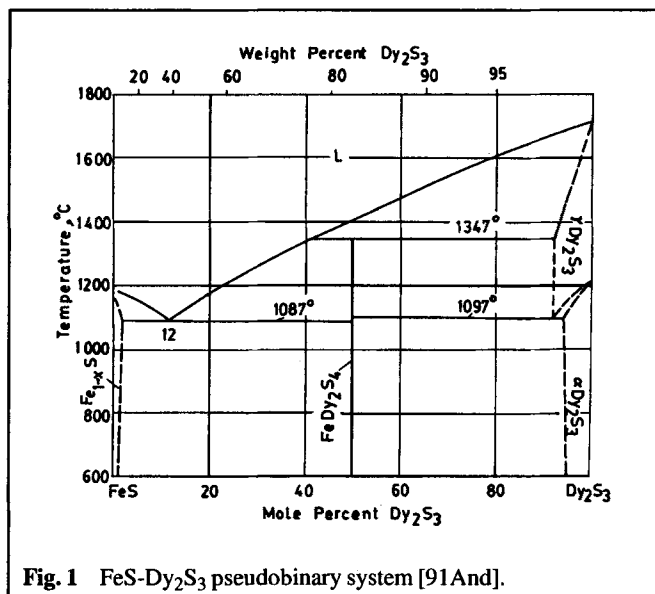


Fig. 1 FeS-Dy₂S₃ pseudobinary system [91And].